Australia's renewable energy policy: the case for intervention

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1 Abstract

As Australia grapples with increasing renewable energy penetration and the appropriate climate change strategy, renewable energy policy plays an increasingly important role. In recent years the renewable energy policy environment has become increasingly politicised and uncertain. The implications for the industry are significant. In light of this policy environment, this paper sets out the economic theory behind public sector market intervention and contextualises it within the Australian renewable energy context. It highlights the barriers facing renewable energy deployment and explores the current status of Australian renewable energy policy. This analysis reveals market failures and other barriers to deployment as well as entrenched enabling policy, regulatory and institutional frameworks for fossil fuel industries. This context was found to justify government intervention to support the renewables sector and improve overall economic efficiency. Building on this analysis, five observations relevant to the development of future renewable energy policy are outlined.

2 Key Words

Energy Policy; Energy; Renewable Energy Policy; Renewable; Policy Development; Australia

3 Introduction

The Australian renewable energy policy environment has undergone a period of rapid change. Since a 2013 review of renewable energy policy [1], there is now a greater emphasis on sectoral efficiency, reducing government intervention and incentivising least cost solutions. Significant policy uncertainty as well as increased politicisation of climate change and policy responses has led to polarity in perspectives and priorities across government and between political parties. There is general consensus, however, that Australian renewables and the energy sector more broadly, are not efficient. Based on this changing policy environment, the purpose of this paper is to :

1. Analyse the underlying economic theory and the implications for Australia's renewable energy policy given barriers to deployment
2. Examine key policy measures and their impact on the future of the renewables sector
3. Discuss the implications of objectives 1 and 2, and make recommendations for future policy strategies.

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The aim of these objectives is to improve the narrative surrounding renewable energy policy and to increase clarity about future policy decisions impacting the electricity, and renewables sector in particular.

Electricity generation produces 33% of Australia's greenhouse gas emissions (GHG emissions), the single largest sector contribution [2]. Approximately 87% of Australia's electricity is produced from fossil fuels in 2012-13 compared to 13% from renewable sources. Electricity emissions decreased approximately 4% from 2012-13 to 2013-14 largely due to reduced electricity demand in Australia's National Electricity Market[2] (NEM) and changes in the generation mix [2]. Renewable generation is predominantly hydro though wind and solar have increased rapidly. Figure 1 shows the change to Australia's generation mix over the period from 2009-10 to 2013-14. There has been a trend away from coal, particularly black coal, towards "other renewables", mainly onshore wind and rooftop PV. Variation in hydro generation is largely due to environmental factors. There is some anecdotal evidence that black coal generators are increasing production due to a slow-down in renewables deployment, but data to confirm this is not available.

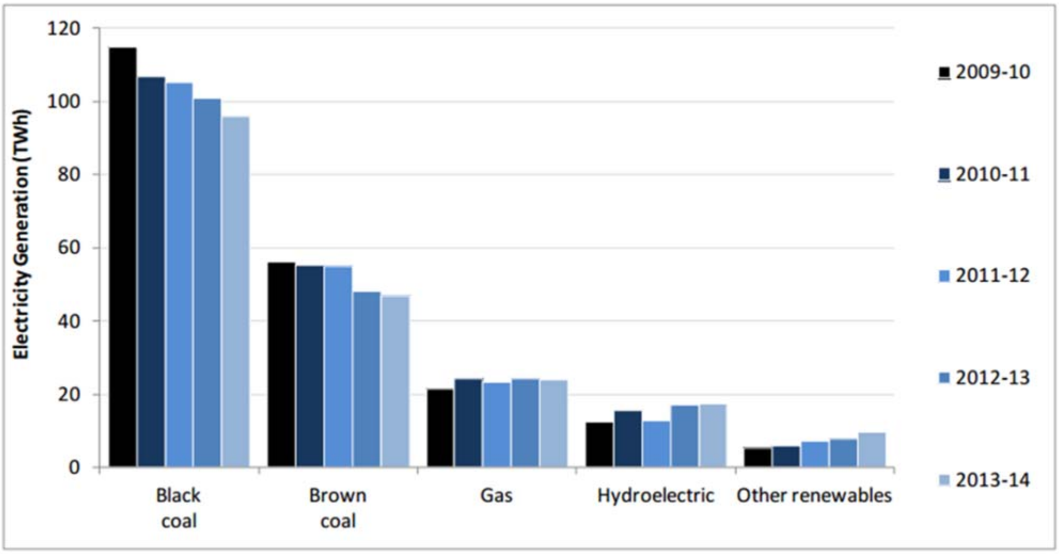

Figure 1: Annual electricity generation mix in the NEM

Source: Based on AEMO data [2]

International and domestic concerns regarding GHG emissions have encouraged successive Australian governments to transition away from fossil fuel based generation. Abundant local coal, gas and uranium resources have driven the development of centralised coal (and increasingly gas) dependent electrification which makes the transition challenging. Utilising renewable energy means not exploiting local mineral resources, and adapting existing infrastructure and institutional frameworks. However, it also provides an opportunity to exploit abundant renewable resources described in [3]. A transition to renewables has the potential to create jobs, arrest cost pressures and improve environmental outcomes.

[2] The National Electricity Market is Australia's largest interconnect network in Australia that covers most of Queensland, New South Wales, Victoria, South Australia and Tasmania

The Australian policy environment has received attention in the literature. A 2013 policy review [1] examined the barriers and benefits renewable policy and key policy initiatives that existed at the time. The Renewable Energy Target (RET) has received the most attention given its importance as a driver of deployment for small and large scale systems. The impact of the RET and the need for consultation to manage stakeholders is examined in [4, 5] while [6] considers the distributional effects of the RET on retail and wholesale prices. Other literature examines the impact of renewable energy integration in the NSW grid [7], and the importance of social acceptance for wind farm deployment in rural Australia [8]. The claim that a high proportion of energy sourced from renewables will increase wholesale costs relative to a (coal seam) gas dependent power system is found to have no justification in[9].

The remainder of the article is structured as follows. Section 4 examines the economic theory related to public policy intervention. This analysis occurs in the context of existing barriers and market failures that impact renewable energy deployment. Given the analysis in section 3, the existing public policy environment is examined in section 5. Section 6 synthesises the discussion and proposes five factors relevant to public policy development.

4 The Need for Government Intervention

4.1 Facilitating market efficiency and public sector intervention

The role of the government is to intervene in cases of market failure and where the intervention increases social welfare. General equilibrium theory provides the fundamental framework for assessing economic efficiency. It assumes that while not every exchange will be in equilibrium, redistribution can occur to allow the markets to achieve Pareto efficiency and equilibrium [10]. When considered together with underlying economic model expounded in [11] it provides the basis for most modern neo-classical, public sector finance, analysis. Pareto efficiency is achieved when it is impossible to make any single individual better off without making another worse off. It assumes that when a market or exchange is not in equilibrium, market failure(s) is the cause. This implies that the role of government is limited to addressing market failures to achieve Pareto efficiency. Implicit in this theory are five key assumptions as to the state of the economy:

1. Perfect competition exists (or sufficient competition to achieve efficiency exchange and price-taking)
2. All market participants have access to all necessary information
3. Barriers to entry/exit do not exist
4. No externalities
5. No transaction costs, and clearly defined property rights

If any of these assumptions fail, then the market can generally be regarded as Pareto inefficient [12]. In these circumstances, government should consider acting to correct the market failure(s) provided that doing so improves social welfare. This focus on efficiency does not make any judgement as to the appropriate distribution to achieve social welfare priorities and can result in significant inequality. Distributional factors reflect interpersonal equity and are defined by social norms and political priorities. In Australia, the use of uniform tariffs is an example of this as they redistribute electricity costs so that rural and urban consumers pay the same cost regardless of the true cost of electricity. This theoretical framework is depicted in

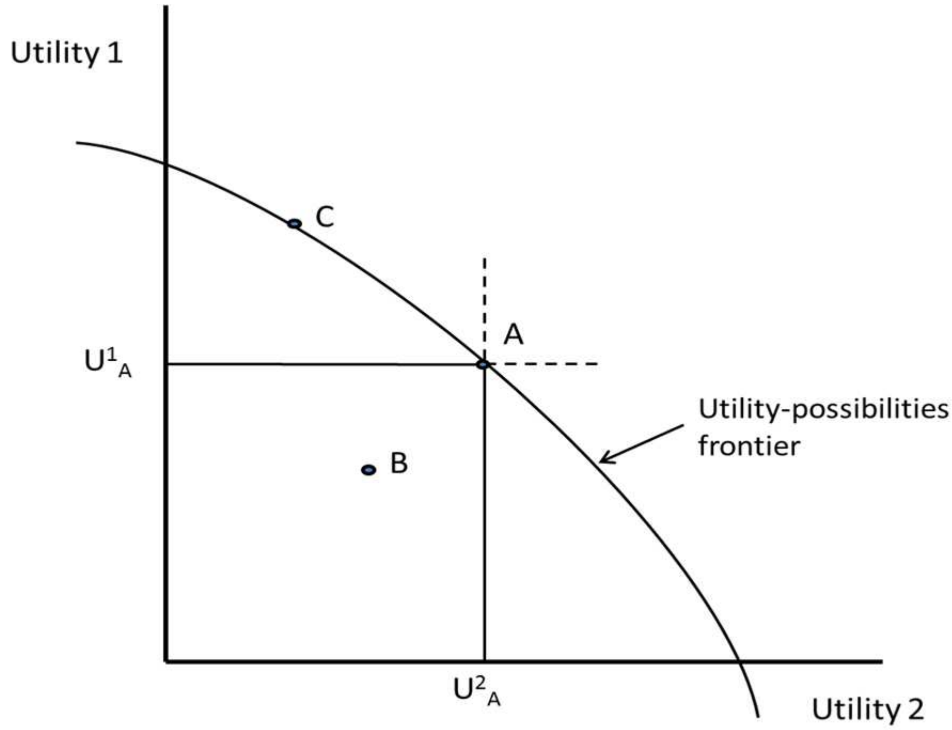

Figure 2 where *A* represents the Pareto efficient point along the "first best" efficiency frontier. The frontier is known as "first-best" because it represents the maximum achievable efficient allocation of resources. Point *B* shows a point where allocation is Pareto inefficient as it is possible to move towards the frontier (i.e. upwards and to the right) while increasing the utility of both agents. Point *C* shows another point on the efficiency frontier. However, shifting from point *B* to *C* means that agent one's utility will increase but agent 2's will decrease. Any point along the efficiency frontier is "efficient" but if shifting from point *B* only a limited range of the frontier is Pareto efficient.

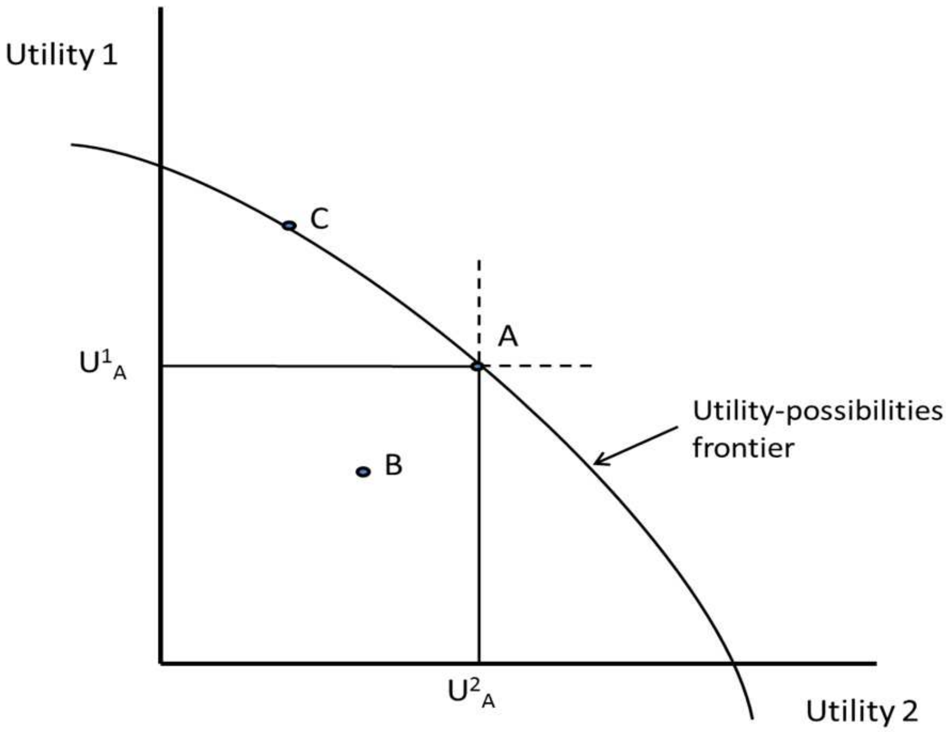

Figure 2: Utility Possibilities Frontier

Distributional effects are not captured in Figure 2. Distribution of resources is important for social welfare reasons, and forms an important component of modern economies. In the energy sector, distributional effects play a significant role (e.g. via uniform tariffs or assistance for low income families to pay electricity bills). Social welfare considerations are captured by the Bergson-Samuelson individualistic social welfare function [11, 13] which result in a series of social indifference curves. This function depicts an ordinal ranking of the well-being of individual members of a society implied by the utility of a single consumer [14]. The theoretical impact of accounting for social welfare is depicted in Figure 3. *W* represents different social welfare indifference curves and *A* represents the "bliss point" [15] where efficiency and net social welfare are maximised.

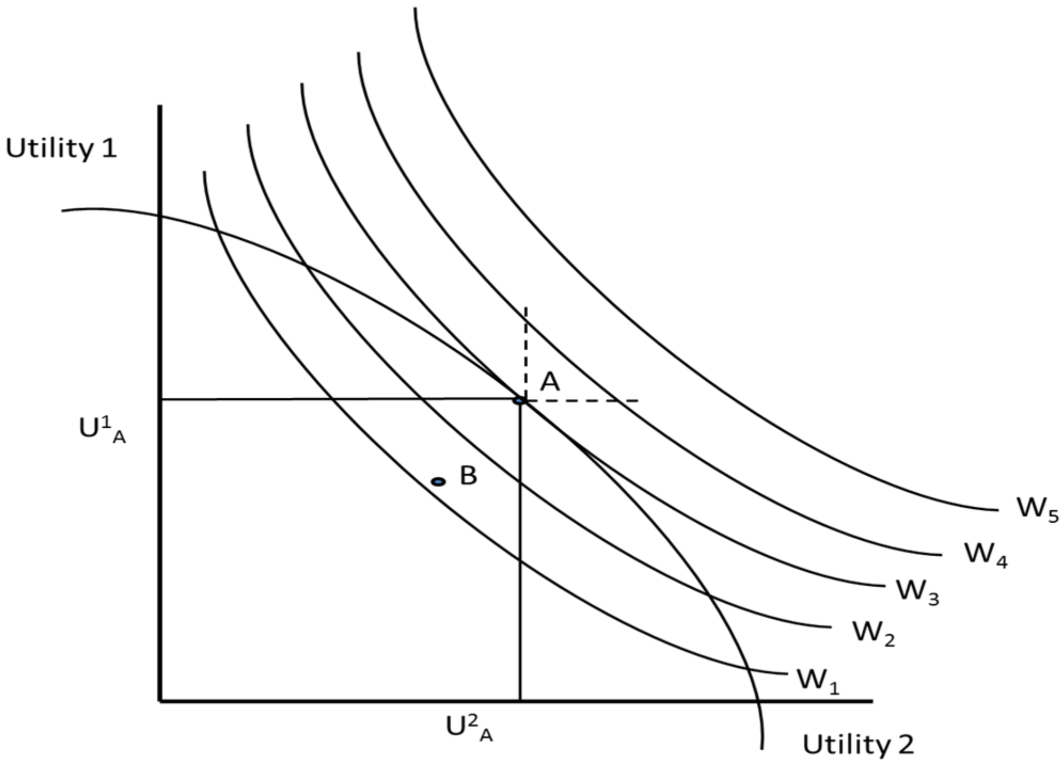

Figure 3: Allocative and distributive efficiency, Pareto and social indifference curves

4.2 The renewable energy context

It is important to contextualise Figure 3 and the renewables sector.

When looking at renewables a number of barriers and market failures frustrate deployment. These effectively shift renewables inside the efficiency Pareto frontier. Current policy settings are centred on increasing sector efficiency and reducing the distributional impacts of environmental (renewable energy) policies. Market failures and barriers identified in the literature that frustrate renewable energy deployment are shown in Figure 4 [16-24]. The extent to which the barriers impact deployment will influenced by the context and stakeholders involved [24]. These barriers are considered in the context of the five core assumptions for general equilibrium theory outlined above. While the barriers can operate in isolation, it is often their interaction and cumulative impact which impacts deployment and viability of renewables.

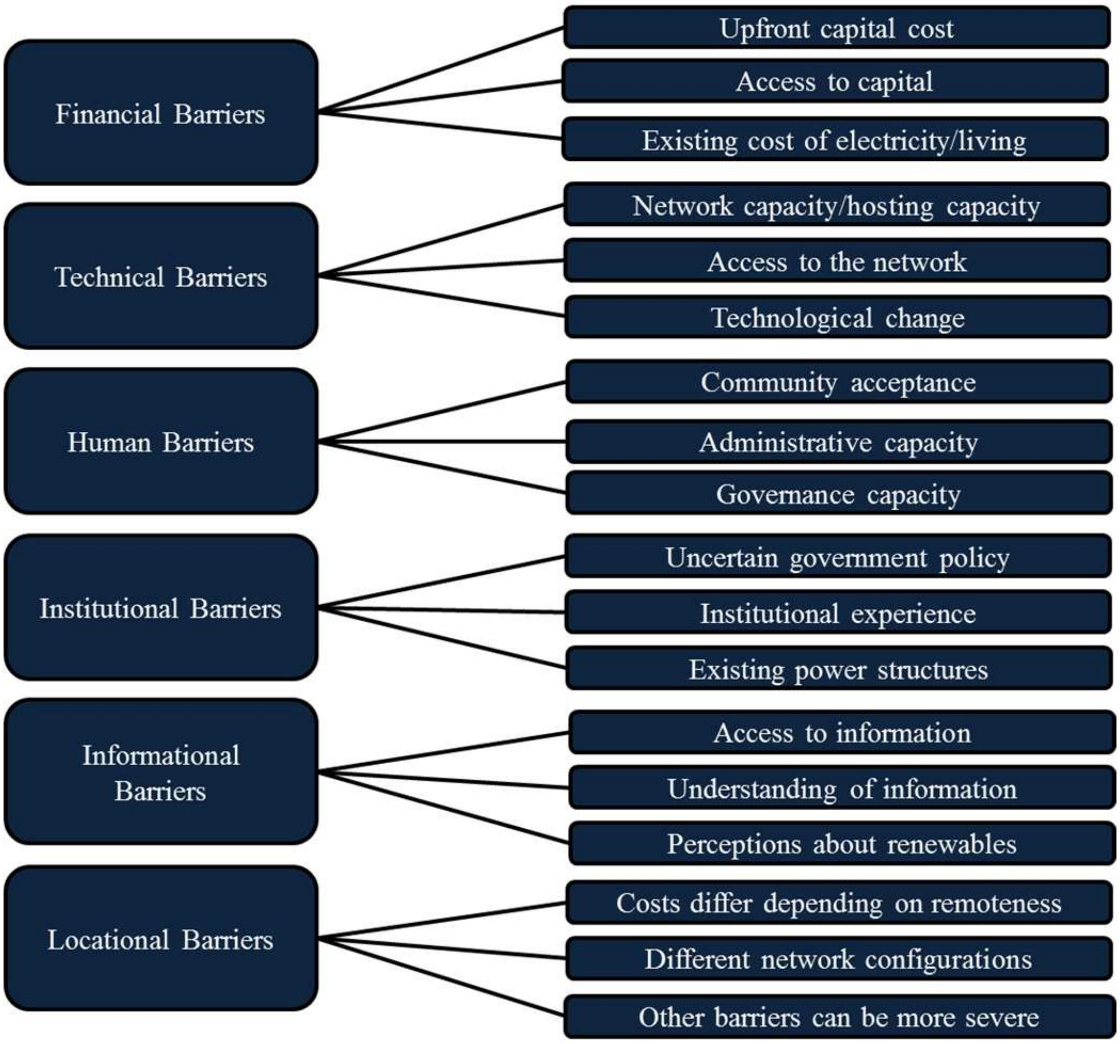

Figure 4: Barriers facing Renewable Energy Deployment

4.2.1 Perfect competition (or sufficient competition to achieve efficiency exchange and price-taking)

Electricity supply is characterised by natural monopolies and unequal market power. Transmission and distribution network operators are natural monopolies which limit competition and access to network assets. While wholesale prices are competitively traded, and in most Australian jurisdictions (at least in urban areas) there are multiple retailers, this only enables limited competition with respect to retail pricing. Wholesale and distribution costs are generally passed through to consumers. Regional areas have even less competition, largely due to vast area, and small customer and use uniform tariffs resulting in operating losses and necessity for community service obligations.

Competition is also restricted by significant regulatory compliance requirements and changing dynamic of what “product” is sold. For example, is the product electricity, capacity, ancillary network benefits, resilience or other benefits? The current market structure is structured to only trade in electricity which makes commoditisation and competition in other products difficult.

4.2.2 All market participants have access to all necessary information

Electricity supply in Australia is characterised by information asymmetry. Different stakeholders possess information and control access to it. For example, DNSPs possess information relating to network capacity, supply costs, condition and future plans of existing infrastructure and load profiles. Installers know about installation and technology costs. Information asymmetry means that investment decisions can be problematic. Accessibility of information differs between State and Territory jurisdictions, and even between organisations within the same jurisdiction. Furthermore, information provided can be complex and difficult to understand especially for unsophisticated investors (like communities and some SMEs). Cost and reliability data is generally not publicly available due to its commercial sensitivity, especially for large systems and regional areas. The potential for strategic disclosure of information also exists because it can increase the power and negotiating position of the disclosing organisation.

Even assuming information is available to be acted upon it needs to be understood which links informational and human barriers. Lack of understanding can result from limited education, the style and format of communicated information and incumbent stakeholders failing to account for varying sophistication. Incumbent stakeholders with experience in electricity supply will understand information differently to less sophisticated stakeholders. Because electricity planning and renewable energy are complex, people involved in the process must be equipped to understand technologies and work with diverse stakeholders. Limited availability of human expertise and administrative/ governance capacity is challenging particularly for individuals, communities and SMEs.

Human and informational barriers play a key role in shaping perceptions and expectations because they inform local acceptance of projects and technologies. This can cause difficulty with deployment of certain technologies (e.g. wind which continues to face the NIMBY[3] phenomenon). For example, community health concerns about wind farms prompted a recent government report that found no evidence that wind farms have public health implications [25]. Public concerns can incorporate a broad range of factors and social engagement is important to effectively to manage them [26]. The ability to pursue renewable energy is limited by human and informational barriers.

4.2.3 Barriers to entry/exist do not exist

There are barriers to entry in the electricity market. These can be broadly separated into financial, technical and institutional barriers and are briefly outlined below.

Financial barriers

Financial barriers relate to the need for and ability to raise upfront capital, the ability to source and access capital (for reasonable cost), the relationship between rising costs and decreasing capacity, and the need for investment certainty. Financier inexperience with renewable technologies and project innovation can result in high transaction costs and make risk assessment difficult. Further, costs associated with managing intermittent generation and grid integration are often necessary. These costs arise due to the need to connect to established legacy networks that are not designed to connect intermittent distributed generation originally built using public funds. Generally these adaptation costs are borne privately but provide no additional revenue stream. The RET, Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC)[4] currently operate to help overcome these barriers in different ways. Their success is limited particularly

[3] Not In My Back Yard
[4] The RET, ARENA and CEFC are examined in section 5

regional and remote areas which face additional financial and non-financial barriers that change risk profiles and require more innovation.

Investment certainty is important because it facilitates access to finance and helps justify deployment. Obtaining long-term power purchase agreements can be difficult, especially for SMEs, councils and communities that possess limited market power. The uncertain policy environment means government linked capital costs, and revenue streams are heavily discounted over the project life. For prosumers (consumers that could become generators as well), the inverse relationship between the existing cost of supply and resulting incentive to seek alternatives is complex. As electricity costs increase, they are incentivised to seek alternatives as depicted in Figure 5. However, their financial capacity to do so reduces due to higher energy costs. Reduced financial capacity can have consequential impacts making it harder to assess projects and obtain finance.

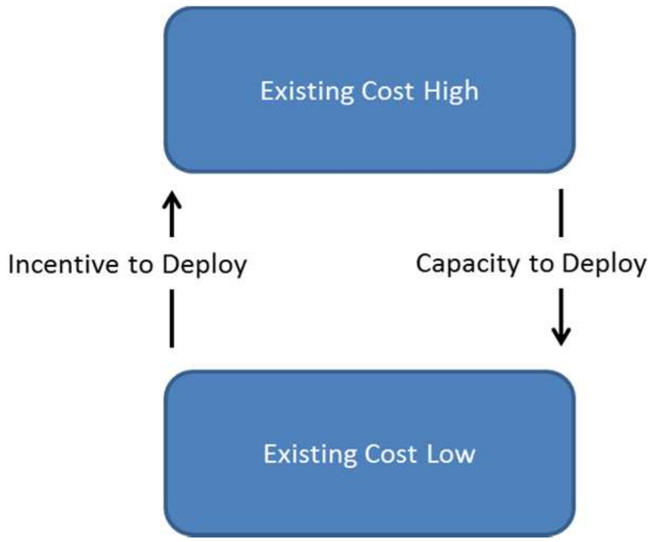

Figure 5: Relationship between existing cost and capacity to deploy

Technical Barriers

Closely linked to financial barriers are technical barriers. Renewable technologies are diverse, and generally characterised by intermittent generation. The need for reliability and integration (with a grid, or local storage) creates technical challenges. In addition, continuing technological development means that system adaptability is required. Australian network connection rules differ between urban and regional networks and for different sized installations. DNSPs are responsible for network stability and power quality reflecting their regulatory obligations and ownership of network assets. Consequently, they are sensitive to any potential network impact of new connections. Efforts have been made to limit connection charges. However, the depth of network augmentation (and resulting cost) is generally locationally and technologically dependent. Areas with existing network constraints and/or older infrastructure are likely to be more expensive than newer higher capacity networks. Consequently, the business case for deployment can be locationally dependent, resulting in trade-offs between suitable locations and network connection costs. In one sense, trade-offs of this type are efficient in that they require installations to align best with the existing network. However, they can also lead to the selection of sub-optimal locations disadvantage stakeholders with no locational flexibility (like rural communities). Project applicants may also be reluctant to augment the network if it enables free riders to exploit those upgrades. This can create a first mover disadvantage and incentivise deployment delays until the network is upgraded by the DNSP or a competitor. The obvious game changer in this context is storage which will play an increasingly important role in both the supply and demand side deployment. The potential for storage to significantly change the electricity environment is increasingly recognised, though its impact remains uncertain [27-30].

Institutional Barriers

Existing institutional frameworks shape the power of individual stakeholders and the distribution of benefits and costs. Government policy and regulatory requirements generally reinforce the integrity of these frameworks. Consequently, the potential for political influence over incumbent stakeholders (especially DNSPs) is real. DNSPs are under pressure to reduce investment in networks (one of the key drivers of recent electricity tariff increases in Australia [31]). This can result in a preference for operational rather than capital expenditure which favours fossil fuel generation over renewables. Further, tariffs across the NEM are likely to become increasingly cost reflective to provide “more efficient price signals to consumers” [31].

Historically, there has been little need for incumbent stakeholders to adapt due to a captured market. The role of the consumer has been price taker. However, the rise of the prosumer means that this is changing. Renewable energy deployment must occur within existing institutional and policy frameworks. Intermittency and the potential for distributed generation (even on isolated grids) do not readily align with these frameworks. Current policy that reinforces existing frameworks does so at the expense of renewables. The market can drive innovation and present opportunities to incumbent stakeholders but these opportunities must be incorporated into the existing electricity supply framework (or else operate entirely independently). This requires adaptation by incumbents that can be frustrated by institutional inertia and regulatory boundaries and result in tension between the need for adaptation and erosion of traditional business models. Installing renewable requires consideration of timeframes much longer than election cycles. It is difficult to make investment decisions dependent on ongoing government incentives in the absence of certainty. Given the recent history of policy uncertainty and the inclination by stakeholders to discount government policy, assurances may need to be provided via contractual or other legal instruments that are less vulnerable to political changes. Alternatively, a bipartisan approach that supports electricity adaptation would comfort investors, but some time will have to pass before the private sector becomes assured increased certainty will continue.

It is important to also recognise the role of the enabling policy environment that supports the fossil fuel sector. Significant direct and indirect subsidies for fossil fuel industries exist and have been increasingly the focus of debate. In 2003, direct subsidies were calculated as $6.5b [32] increasing to $9.3b-$10.1b for the 2005-06 period [33]. More recent calculations put the subsidy closer to $11 billion [34] with estimated annual subsidies devoted to mineral exploration estimated as between 2.9b and $3.5b [35]. A significant proportion of these subsidies relate to transportation and mineral extraction sectors, and not electricity generation directly (though some do). However, drawing an arbitrary distinction between direct and indirect subsidies is of limited utility. Generation is not isolated and cheaper inputs will influence costs and mask the true cost. Off-grid diesel networks in

Australia benefit from significant fuel excise exemptions which partly shift the cost of diesel generation from utilities and state electricity consumers to the national tax payer. They create an unequal playing field that reduces the competitiveness of renewable energy and supports the continued dominance of fossil fuels in Australia's energy mix. In addition to the subsidies referred to above, regulatory frameworks also frustrate renewable energy deployment. In 2009 [36] concluded that Australian energy policy has hidden biases that regard waste problems from coal, oil, gas and nuclear energy as inherently solvable. In contrast, intermittency, storage, cost and other challenges are regarded as insurmountable, at least in the short term. Following release of the 2015 Australian Energy White Paper (the White Paper) - a document that sets out the Australian government's energy policy priorities, this issue arguably remains relevant. The White Paper's emphasis on low emission technologies as critical for Australia's energy future and the challenges associated with renewable technologies is not dissimilar to factors identified in [36]. Enabling policy provides a non-financial advantage that favours incumbent approaches and stakeholders at the expense of new technologies and approaches that may disrupt the status quo.

The failure to price environmental externalities are a key market failure that supports emissions intensive generation at the expense of zero (or even low) emission technologies. The RET provides a mechanism to reduce electricity generation emissions, but broader and consequential emissions are not captured. The now repealed carbon pricing scheme provided a mechanism to do this, though there was significant controversy over the appropriate price. Transaction costs in renewable energy deployment can be high due to lack of standardisation of designs, technologies, implementation and deployment and outdated government standards. Distributed generation enables flexibility but this can increase transaction costs associated with project development. Property rights are also problematic. At present, renewables provide both benefits and costs that are captured and shared unequally between private and public stakeholders. For example, significant penetration in a rural grid is likely to reduce supply costs until network reinforcement or augmentation is required. At that point access challenges outlined above are likely to be encountered. Given uniform tariffs, there is no ability to capture any reduction in local supply costs or consequential network benefits unless provided by the DNSP. There are broader public policy considerations relevant to who should be responsible for network adaptation, but these are not explored in this paper. This reflects uncertainty about what products are being sold and an inability to attain any property right over them.

4.3 Contextualising economic theory

The existence of barriers frustrating deployment and distortive impacts of existing support for the fossil fuel sector and existing support for renewables means the renewables sector will fall inside the efficiency frontier. **Error! Reference source not found.** depicts this conceptually where *R* represents the current location of renewables, and R_* represents the bliss point where the highest social welfare on the utility frontier occurs. Any shift in *R* within the shaded zone will result in an improvement in the utility of at least 1 agent and so is needed to achieve Pareto efficiency. Consequently, efforts should be directed to shifting renewables towards R_* because this maximises net social welfare. Understanding the economic narrative in this way provides justification for decreasing support for renewables as it takes the form of intervention that *should* decrease efficiency and cause unwanted distributive impacts. However, whether this approach will be effective given the market failures and barriers outlined in section 4.2 is questionable.

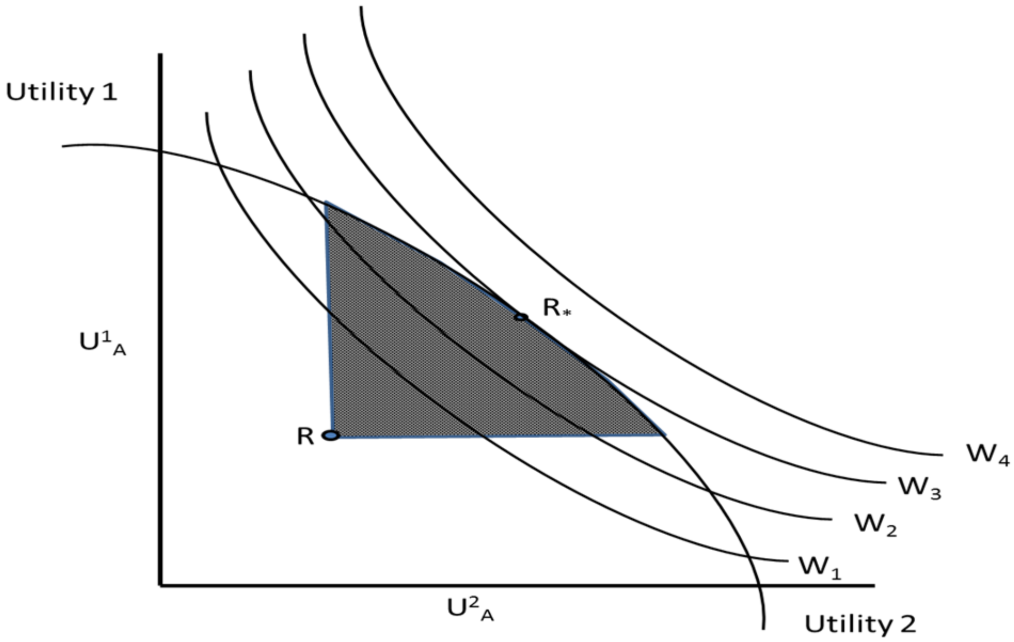

Figure 6: Renewable Energy - applied theory

The ability to actually transition to *R** depends on whether it is possible to address the market failures and distortions. Constraints on the renewables sector means it is not possible to achieve point *R** because entrenched challenges prevent a transition to the Pareto efficiency frontier due to entrenched market failures, barriers to deployment and support for the fossil fuel sector .

"Second best" theory provides a conceptual framework for determining the appropriate government policy strategy in these circumstances. Where optimality conditions are breached as they are in the case of renewables (for the reasons outlined above) the second best solution is to change other variables in a way that would ordinarily decrease efficiency [37, 38]. Consequently, where it is not possible to remove a market distortion (e.g. support for the fossil fuel industry) further intervention may be the appropriate response. This framework is depicted in Figure 7.

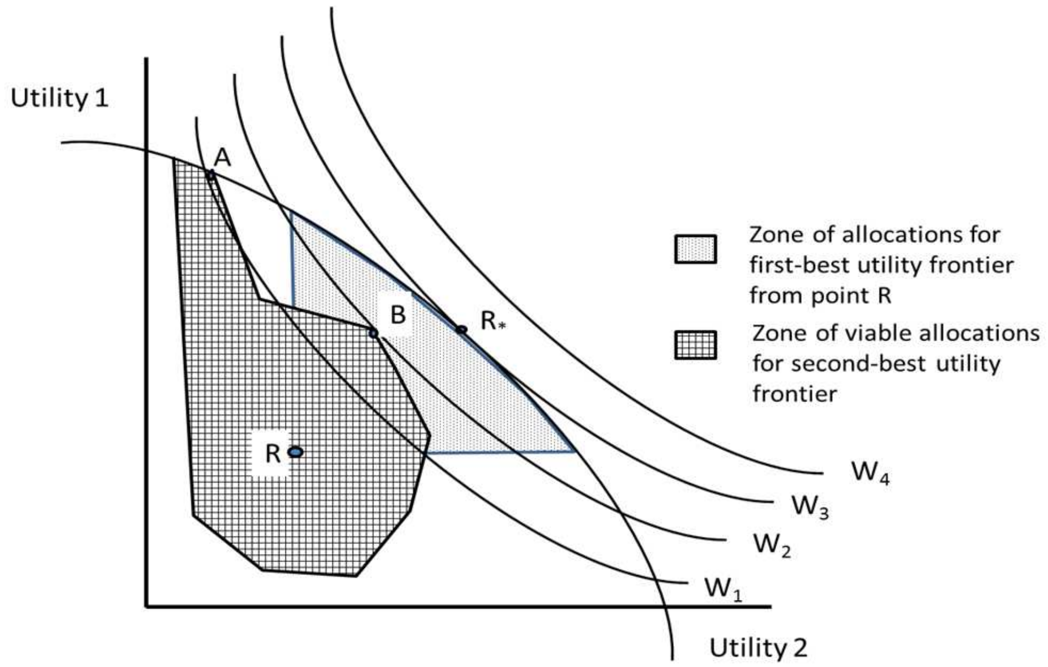

Figure 7: Depicting the second best scenario

The zone of viable allocations shown in Figure 7 reflects constraints on the renewables sector identified as *R*. The constraints are the result of market distortions in the fossil fuel sector of the economy, enabling regulatory and institutional frameworks driving market failures. In Figure 7 it is still possible to optimise efficiency (at point *A*). Point *A* represents a point of intersection between social indifference curve W_1 and the first-best utility possibility frontier. Removing renewable energy subsidies and interventions designed to encourage renewables will increase efficiency in the renewables sector and push it towards this point. While this would increase "efficiency" it does not maximise social welfare because greater social welfare is achievable at point *B.* Point *B* represents the "second best" option because it represents the maximum *achievable* net social welfare given the constraints and challenges outlined above. This leads to the somewhat surprising conclusion that the best outcome is not to encourage efficiency by reducing intervention, but rather to increase intervention.

Current policy settings favour existing (fossil fuel) generation resulting in a sector that is bigger than it otherwise would be. This is an inefficient allocation of resources and reduces the efficiency of the economy as a whole. One of the key criticisms of the RET is that it inflates incentives for renewable energy deployment resulting in oversupply of electricity generation [39]. Ignoring discussion about the utility of keeping aging infrastructure operational, this criticism can equally be directed at policy and institutional frameworks benefiting the fossil fuel sector. In these circumstances, adopting a policy approach that reduces intervention in the renewables sector is counterproductive. Focussing primarily on the efficiency of renewables ignores the distortive impact of existing interventions in the fossil fuel sector and other market failures that have distortive impacts on renewables. Unless efforts are made to reduce all distortive impacts (including enabling regulatory and policy frameworks) then focusing on the sectoral efficiency of renewables is not appropriate. Such a focus will likely lead to a reduction in the renewables sector which will be taken up by fossil fuels and exacerbate pre-existing inefficiencies. Counter-intuitively this means the most efficient outcome for the economy as a whole is targeted intervention that supports the renewables sector, because it results in an increase in net social welfare.

The implications of this conclusion are significant. Unless efforts are made to reduce direct financial subsidies and enabling regulatory and institutional frameworks benefiting the fossil fuel sectors a first-best outcome that maximise social welfare is not achievable. In these circumstances, the appropriate policy response is intervention to support the renewables sector. The question then becomes what type of support is appropriate. In this context, the current renewable energy policy environment is examined in section 5.

5 Current renewable energy policy environment

As mentioned in section 0, a change of Federal government in Australia has led to a dramatically different renewable energy policy environment. The policy environment is characterised by uncertainty. Policy priorities differ between political parties, and even within the same parties. At the Federal level, political uncertainty over leadership on both sides of politics means that internal party priorities contribute to broader uncertainty. The new policy environment is focused on least cost production, reducing electricity costs, and allocative efficiency and enabling the development of Australia's extractive industries, particularly the gas sector. A new Energy White Paper (the White Paper) which sets out the Australian government's energy policy goals and political ideologies has recently been released [40]. The White Paper builds on the interim Energy Green Paper themes of reducing energy cost pressures on households and businesses, improving international competitiveness, increasing exports and removing "inappropriate interventions that get in the way of business competition and innovation" [41].

The White Paper is centred on the themes of increasing competition to reduce consumer costs, increasing energy use productivity and investment to facilitate innovation and resource development. There is recognition that Australia's energy mix will become more diverse overtime, but that is thought to be the result of market operation and efficient investment. Cost reflective tariff pricing is identified as an important vehicle to encourage demand management, reduce network investment (which is driven by peak loads) and costs. Much of Australia has regulated or uniform tariffs. While there are benefits associated with such an approach relating to reduced cross subsidies and reduced pressure on network investment, there appears to be limited recognition on the potential for equity issues. Arguably it also ignores the difficulty associated with load shifting and the role of non-financial signals for electricity demand behaviour for some electricity consumers. Rural electricity consumers who benefit from subsidised electricity due to the high local supply cost are likely to be particularly vulnerable to cost reflective tariff policies. This raises issues associated with regional development, equity and the potential need for locationally dependent tariff policies. It should be noted that tariff policies are a state and territory responsibility and the Federal government has little direct control over them, though it can exert influence.

There is relatively little direct policy discussion with respect to renewable energy. The policy focus is largely on keeping a (reduced) renewable energy target, and abolishing the Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC). These government agencies are designed to facilitate commercialisation of renewable energy technologies and access to finance. Internalising environmental externalities including emissions from fossil fuel generation is not prioritised, though emissions abatement is a priority. However, there is policy support for low emission technologies, particularly coal through carbon capture and storage. The government policy environment is intended to be technology-neutral because “investment decisions on future generation assets, including choice of technology, are best made by industry, given its insights into market needs” [40]. The focus on removing regulatory barriers and providing subsidies reflects the view that they “distort energy markets, shielding competition and diluting price signals” [40]. Market interventions and regulations should “encourage competition and consumer choice and not stifle it” [40] and any need to regulate requires balancing of the costs and benefits of doing so. There is an inherent focus on using competitive energy markets to define investment outcomes. Policy appears to be largely focused on driving competitiveness, energy exports (coal, gas and uranium) and the development of the gas industry. The role for renewables is seen as important only to the extent it is cost competitive with existing generation and technologies. The central tenet of energy policy appears to be reliance on market mechanisms to competitively determine the optimum generation mix and supporting extractive industries, particularly for export markets. This implies that the market will adequately direct resources and develop innovative solutions to integrate it into the future energy mix as required. This is effectively a belief that a mechanism akin to the Kuznets curve [42, 43] will enable the market to recognise and effect responses to energy and environmental challenges when necessary.

Somewhat surprisingly, the White Paper does not outline a policy approach to manage the potentially disruptive impacts of distributed renewable generation (and storage) on electricity networks though it does acknowledge the potential for disruption. The rapid deployment of household rooftop PV systems across Australia and potential for commercial and larger systems to be installed means that this issue may become significant. Across Australia more than 4 GW of solar PV has been installed (primarily on residential rooftops) with annual generated energy estimated at 5,655 GWh [44]. Queensland and South Australia have significant penetration with more than 27% of households having solar PV [44]. If distributed generation increases in penetration network operators may have to reframe their businesses and network operation to manage multiple producers and consumers dispersed throughout the networks, rather than a largely unidirectional (generator to consumer) distribution process.

Table 1 shows changes to key policies in existence impacting renewables that have occurred since 2013. These are discussed in more detail below. The focus is on examining the role and implications of the policies (and any changes to them) rather than outlining their functions. More detailed analysis of most of the policies can be found in [1]. [45] also provides a useful review of the status of renewable energy deployment and key State policy priorities.

Policy instrument	In Existence?	Comments:
Emissions Reduction Fund	Yes	The ERF is a recent policy initiative designed to encourage least cost investment abatement. However, it is unlikely to directly support the renewables sector.
Carbon pricing Scheme (Operative 2011-2014)	No	The scheme was repealed in 2014. A price on carbon is unlikely in the short term.
ARENA	Yes	The future of ARENA is uncertain. The Federal government has committed to its closure but has so far been prevented by the Senate. If closed, the government will honour existing funding

		obligations.
CEFC	Yes	The future of the CEFC is uncertain. The Federal government has committed to its closure but has so far been prevented by the Senate. If closed, the government will honour existing funding obligations.
Renewable Energy Target (RET)	Yes	The RET is likely to be in 2015 from 41,000 gigawatt hours by 2020 to 33,000 gigawatt hours in 2020, biannual reviews will also be removed.
Electricity Tariffs	Yes	FiTs still exist in Australia though they vary significantly between States and Territories (and even within them). Tariff reform is increasingly on the agenda.

Table 1: Key renewable energy policies and their status

5.1 The Emissions Reduction Fund (ERF)

The ERF worth $AU 2.55 billion is the key climate policy of the Federal government. It aims to reduce household and organisations' GHG emissions using positive incentives (or subsidies) via a silent auction process. The government imposes an undisclosed maximum bid price above which it will not pay for any projects and commits to purchasing 80% of the volume of emissions below the maximum bid price for each auction [46]. If successful at the auction, carbon credits are paid at the bid price. Successful projects are selected solely on whether they have the lowest bid price. This policy is likely to direct emission reduction strategies to least cost projects and favour smaller incremental changes (e.g. forestry and replacement of lights in industrial buildings, existing) over more capital intensive (and expensive) projects.

The underlying objective is to help Australia "meet its emissions reduction target of five percent below 2000 levels by 2020" [47] through a scheme that enables the cheapest emissions reduction methods thereby reducing costs and increasing productivity [48]. A non-exhaustive list of projects covered by the ERF include [49]:

- Improvements in energy efficiency
- Reductions in electricity generator emissions (e.g. Via technological improvement)
- Capturing landfill gas
- Reducing waste coal mine gas
- Reforestation and revegetation
- Improving agricultural soils

In April 2015, the first ERF auction was held where more than 47 million tonnes of carbon emissions were abated at an average cost of $AU 13.95/tonne [50]. Almost 60% of the funds were directed to sequestration projects (generally payments to farmers to prevent them from clearing land or sequestering carbon in land). Landfill and waste emissions capture approximately constituting another 38% [51]. The key challenge for this policy is distinguishing between new emission reduction strategies, and projects that would have occurred anyway. There is a significant risk of inefficiency if supported projects are not in *addition* to what would have occurred anyway.

The ERF is new in Australia so it is difficult to assess its impact on the renewables industry. However, given its objectives and focus on energy efficiency and emissions capture and storage it is unlikely to be conducive to renewable energy deployment. It effectively provides a subsidy for existing generators to reduce emissions at the expense of renewables (thereby encouraging their continued use). The scheme provides significant support to existing operations but does little to support new businesses and households that do not have a track record of emissions to abate. This type of grandfathering can be problematic when significant reform to existing approaches is needed. Nevertheless, the ERF is complementary to existing programmes “that are already working to reduce Australia’s emissions growth such as the Renewable Energy Target…” [52]. However, given the commitments to reduce the RET and remove ARENA and the CEFC it is unclear how this will work in practice.

5.2 Carbon pricing

The carbon pricing scheme introduced by the previous Labor government was designed to internalise carbon costs for major polluters. One of the primary election platforms for the current Federal government was removal of carbon pricing which occurred in 2014 (after some negotiation). Consequently, there is no longer a price on carbon in Australia except that which is provided via the ERF. However, other measures that formed part of that scheme (including ARENA and the CEFC) have not been removed, yet. Hostility to pricing carbon in some parts of the Australian electorate means that in the absence of political leadership (or a global agreement) a carbon trading scheme or tax is unlikely in the short term.

5.3 The Australian Renewable Energy Agency (ARENA)

Fundamentally, ARENA’s role is to improve competitiveness of renewables, and increase renewable energy supply [53]. It is technology agnostic and focused on eroding technological and commercialisation barriers and knowledge sharing. The Australian government has committed to closing ARENA but has so far been prevented from doing so by the senate[5]. Notwithstanding its pending demise it continues to assess and fund projects and has indicated it will continue to do so until it is closed. The government has committed to honouring funds allocated by ARENA at the time of its repeal.

ARENA performs an enabling role for projects and initiatives facing technical or commercialisation challenges that prevent market support. It tends to focus on commercialising technology rather than approaches. However, commercialisation challenges for some projects, particularly in remote communities are often complex and multi-faceted and may not readily fit within ARENA’s remit.

Uncertainty surrounding ARENA’s future is not conducive to renewables deployment. Developing projects is time and resource intensive. The incentive to allocate time and resources is likely to reduce given uncertainty about ARENA’s future.

5.4 The Clean Energy Finance Corporation (CEFC)

The CEFC is a government funded financier created to help overcome financing challenges associated with clean energy development (including renewable energy and low emissions technologies) though it does cooperate with ARENA. It is focused on providing finance at a concessional rate for clean energy projects that have a positive rate of return. The concession depends on external benefits provided by the project and can take the form of lower costs, higher

[5] Federal legislation must pass through the House of Representatives (lower house) and then the Senate (upper house) before it becomes law. The Federal government controls the lower house but does not have control of the Senate.

risk or longer duration [54]. As at 30 June 2014, the CEFC had a portfolio of $931 million for total project value of more than $3.2 billion [55].

The Australian government has committed to the closure of the CEFC but has so far been prevented by the Senate. The justification for closing the CEFC appears to reflect the view that government should not provide funds if the project risk profile is not acceptable to the private sector [56]. The CEFC CEO noted that the complex and uncertain policy environment has reduced private financier willingness to participate in the Australian market [55]. Given this environment, the role of the CEFC is critical. The requirement for concessional market returns and tendency to focus on established businesses in an effort to manage the credit risk profile restricts the availability of finance. Larger projects which generally involve more established businesses are more likely to attract finance from the CEFC due to lower transaction costs. Less established organisations with limited access to commercial finance (such as community groups, or small businesses), or smaller projects may be excluded. This may occur due to a lack of standardisation of products, high transaction costs, perceived investment risk, inability to obtain co-finance, locational challenges or complexity associated with aligning stakeholders.

Nevertheless, the CEFC provides an important pathway through the financial barriers associated with accessing capital particularly for large scale renewable energy deployment. Uncertainty surrounding its future is not conducive to further renewable energy deployment, particularly for larger systems.

5.5 The Renewable Energy Target (RET)

The RET aims to reduce GHG emissions from electricity generation by providing certificates for renewable energy generation. Small systems (<100 kW) are provided with upfront payments while large systems are provided with certificates based on MWh generated. Liable entities (generally electricity retailers) must purchase a specified number of certificates. This policy has played a key role in facilitating renewable energy deployment and reducing emissions in Australia. Following its election win, the Federal government signalled its intention to reduce the target and ordered a review of the RET. In 2014, a review of the RET [39] concluded that:

- It provides an incentive for investment in renewable energy generation that is not necessary to meet demand, and which is not viable without the RET subsidy.
- Incumbent generators, electricity retailers and consumers fund the RET via a cross-subsidy.
- Its impact on electricity prices is small (and downward)
- Given changes in the electricity environment, approximately $13 billion of large scale generation will be developed that is not required
- The cost to the community of the RET is too high given the availability of alternative (lower cost) emission abatement alternatives

Following this review the Federal government committed to a reduction in the RET and originally sought a target of 26,000 GWh. Negotiations regarding a new RET have been protracted. At the time of writing the RET of 41,000 GWh of renewable generation from large scale renewables by 2020 is likely to be reduced in 2015 to 33,000 GWh. This reflects the agreed amount between the two major parties following protracted negotiations. Further, there has been controversy about the inclusion of wood waste as a renewable energy source of renewable energy, and exemption of trade exposed industries from the RET. Small (<100 kW) systems are exempt from any RET changes. At the time of writing, the new agreed target is not law as it has yet to pass the senate.

The implications of reducing the target are significant as the RET has enjoyed bipartisan political support since its inception. Energy projects require long planning and investment horizons. Reducing the RET target will put downward pressure on RET certificate prices thus reducing the subsidy and financial viability of projects greater than 100 kW (including those that have already been constructed). Referring to uncertainty about the RET target the CEFC CEO noted (referring to Bloomberg reporting) that “the amount of investment within the large sector for renewable energy is about back to the same level it was in 2002... ” [56]. Uncertainty in the renewable energy policy environment, particularly around the RET led to an 88% reduction in large scale renewables investment in 2014 [57, 58]. A number of studies have considered the impact of RET uncertainty and the RET more generally. The RET was identified as an important driver of the development of Australia’s renewable energy industry particularly for larger installations in [59] and emissions reduction strategy . In 2014, the RET contributed to emissions reductions of approximately 10% of Australia’s total emissions [57]. If the RET remains unchanged, renewable energy is estimated to account for between 22.6% [58] and 26% [59] of Australia’s electricity generation by 2020. However, some of the additional generation capacity will be surplus to Australia’s needs given the existing (fossil fuel) generation stock. [59] conclude that the cost of emissions is high relative to international standards and the impact on wholesale prices is relatively low (and negative). Using different modelling assumptions it was concluded that removing the RET will increase wholesale and retail electricity prices, and that the RET cost is largely offset by reductions in wholesale electricity prices [58]. If the RET is maintained, an estimated 18,400 jobs will be created between 2014-20 [58]. Notwithstanding the advantages of the RET, much of the large scale investment has been in onshore wind, and there are issues associated with subsidising technologies that are approaching (or at) cost parity at the expense of less mature technologies. This may unnecessarily subsidise projects that do not require support to be cost competitive.

The RET has played a key role in facilitating Australia’s renewable energy deployment. If the reduced RET target becomes effective, it will help reduce uncertainty by providing a floor target that is unlikely to be reduced in the future. Uncertainty surrounding the RET has contributed to significant reduction in renewable energy investment particularly for large-scale systems and it remains to be seen how the industry responds in the future.

5.6 Tariff policies and Feed in Tariffs (FiTs)

Tariff policies are a State and Territory responsibility. Household FiTs have generally been reduced across all States and Territories and are now generally low (e.g. ~\$0.06-\$0.07/kWh) relative to electricity tariffs (~\$0.24-0.30/kWh) with few exceptions. The value of household PV exported to the grid is uncertain due to information asymmetry about network impacts and capacity to offset wholesale prices. However, in New South Wales, it is estimated at between \$0.049-0.093/kWh (median \$0.056/kWh) based on the estimated wholesale electricity costs [60]. In Western Australia, the regional DNSP[6] developed a scheme with FiTs up to \$0.50/kWh to encourage deployment (especially in off-grid diesel networks) though this has had limited success due to a range of financial and non-financial barriers [61]. The rationales for FiT reductions are twofold. Firstly, that household

[6] Distribution Network Service Provider

solar PV is relatively cost competitive in urban areas. Secondly, that the cost of network adaptation and declining revenue covering the same asset base results in a distributional impact across the network, especially for people who do not have solar. [62] examined the NSW FiT scheme noting due to issues with policy design it has high public costs that will lead to conflict between investors, energy retailers and even require retail price adjustment.

The role of FiTs in Australia is declining except for encouraging deployment in high cost off-grid networks. While this avoids any potential issues arising from cost redistribution, it erodes financial incentives for deployment. The increasing focus on network adaptation is likely to see network access costs (or smoothing requirements) allocated to installers.

The tariff policy context in Australia is important. Uniform tariff policies are generally used. These have significant distributional impacts, particularly in regional areas where supply costs can be much higher than tariff rates. Tariff reform is increasingly on the policy agenda and is likely to see a trend towards higher fixed connection charges, and lower variable costs to reflect distribution network costs. In addition, greater use of time of use tariffs to encourage demand management appears likely. This is problematic and unlikely to result in long-term efficiency as people have different abilities to adapt. Further, tariffs are a blunt tool and do not allow stakeholders to effectively capture uncommoditised benefits such as improvements in reliability, network capacity and power quality – especially when storage is used. Governments, retail and distribution businesses need to rethink tariff policy to reflect the changing nature of electricity networks. As distributed generation penetration increases, the potential to use renewable technologies and storage to optimise network operation is significant. Policy should proactively look to exploit opportunities that result and not reactively respond to challenges that may develop where inappropriate policy is used. Capacity payments, lump sum payment of operating subsidies for innovative solutions in regional areas (rather than allocating per consumer) and flexibility to adapt to changing technologies will become more important overtime as technology matures.

6 Implications for policy development

While proposing specific policy responses is beyond the scope of this article, five observations relevant to future policy development are outlined below.

Firstly, policy must be responsive to key barriers and challenges facing renewables. There are inherent difficulties associated with an economy wide "second best option" because of the interrelationship between static and dynamic distortions and flow on effects from intervention [63]. The range of possible market distortions is broad, each with many exceptions [64]. Where more than one distortion exists (e.g. direct subsidies, tax exemptions, monopolies, externalities) then they can reinforce, or wholly or partially offset each other [64]. The second best approach assumes the distortion can be recognised and a welfare improving policy developed [63]. However, this generally requires a single isolated distortion. The renewables sector is characterised by a number of distortions that are interrelated including (but not limited to) changing technology under uncertainty, presence of externalities, locational factors and other market failures.

Secondly, new interventions must recognise the impact of existing policy instruments. While not responsible for all barriers, policy plays a role in contextualising incumbent and industry responses which frustrate deployment. For example, network access barriers reflect the power of DNSPs over network assets. Consequently, local stakeholders have limited ability to influence prices or the distribution of benefits (or costs) associated with network access. Connecting distributed generation is a relatively new challenge for DNSPs that requires adaptation of existing infrastructure and new electrification approaches. The implications are significant. As consumers become less of a captive market and storage becomes more accessible, they may elect to disconnect from the network altogether or island their demand relegating DNSPs to the role of "back-up" suppliers and accelerating the "death spiral". This will have major ramifications for business models and likely result in significant restructure of DNSP businesses and redistribution of costs and benefits.

Thirdly, policy must be contextualised. Applying general policy rules for piecemeal improvements are not effective, but they do help identify possible strategies for shaping policy responses provided that policy is contextualised [63]. Context is critical when targeting specific entrenched market distortions. In the energy context, sectoral interrelationships mean that there are likely to be spill over impacts from any policy intervention. This is apparent from existing energy policy. Instead of having broad economy wide policy objectives (e.g. efficiency of supply and lower energy costs) policy should address narrower objectives. In the renewable energy context objectives may include:

- Levelling the playing field so that renewables can compete effectively with the fossil fuel sector
- Addressing finance challenges (e.g. The role of the CEFC) though also understanding challenges associated with transaction costs and new businesses
- Transitioning along the commercialisation pathway (e.g. Part of the role of ARENA)
- Addressing other challenges outlined in section 3
- Developing initiatives to overcome institutional and regulatory barriers
- Addressing policy uncertainty

Fourthly, the challenge of operationalising economic theory should be recognised. How do policy makers respond to the reality that first best and even society wide second best outcomes are not achievable? The answer is, with difficulty. For policy makers the focus needs to shift from intervention with broad goals but targeted impacts, to policy focused on discrete objectives cognisant of the broader policy portfolio. Judgements are needed about the implications of unintended policy consequences. Efficiency, equity and public opinion are relevant to policy planning as is understanding of the factors driving distortions. Competitive economies are regarded as the most efficient vehicle for allocating resources (providing a mechanism to achieve Pareto-optimality exists). Any intervention or distortion that forces economies or sectors away from allocative efficiency is, in principle, undesirable. However, intervention is justified in certain circumstances. Those circumstances require strong, defensible arguments of market failures and/or political priorities and clarity regarding objectives that justify intervention. An intuitive approach to policy is needed that combines rigorous analysis with the practical realities in modern economies. As [63] (at p.362) note, *"what is needed is a good appreciative understanding of how the price system works, as well as understanding the cautionary warning from second best theory that any policy may have unexpected and undesirable consequences"* .

Fifthly, clearly define the rationale for intervention and policy focus should be clearly defined. Policy making is difficult. While intervention should not be adopted as a *ceteris paribus* position, where intervention occurs in other sectors of the economy, intervention may be justified. The renewable energy sector faces pressure to become more efficient and compete more effectively without the benefit of government intervention. However, environmental externalities, enabling legislation and direct subsidies associated with the fossil fuel sector together with reluctance to recognise their distortive impacts means targeted “second best” interventions are appropriate. Policy should be focussed on addressing discrete clearly defined and considered objectives. Adopting this approach will, counterintuitively, increase efficiency of the economy as a whole. Assessing the viability of the renewables sector without policy intervention requires more rigorous analytical focus than is presented in this paper. However, at least in the short- to mid-term, the government has a role in overcoming market barriers especially given intervention in related sectors. There needs to be recognition of the need for policy certainty into the future. Consequently, future phase out, or thresholds need to be articulated to encourage, so far as possible, greater certainty in policy.

7 Summary

Australia’s renewable energy sector has faced significant policy change and uncertainty in recent years. This paper sets out the economic theory behind public sector market intervention and contextualises it within the Australian renewable energy framework. It highlights the barriers facing renewable energy deployment and explores the current status of renewable energy policy. Five observations relevant to the development of renewable energy policy are outlined. Analysis of economic theory and Australia’s renewable energy policy environment identified significant barriers to deployment, entrenched support, enabling regulation and institutional frameworks for the fossil fuel industry. This context was found to justify government intervention to support the renewables sector and improve overall economic efficiency.

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